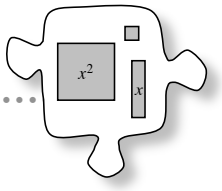
3.1.2 What is a variable?



Naming Perimeters of Algebra Tiles

How much homework do you have each night? Some nights you may have a lot, while other nights you may have no homework at all. The amount of homework you have varies from day to day. In mathematics we use letters such as x and y, called **variables**, to represent quantities that are not constant.

In Lesson 3.1.1 you used variables to name lengths that could not be precisely measured. Using variables allows you to work with lengths that you do not know exactly. Today you will work with your team to write expressions to represent the perimeters of different shapes using variables. As you work with your teammates, use the following questions to help focus your team's discussion:

Which lengths can vary?

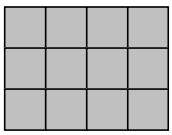
How can we see the perimeter?

How can we organize groups of things?

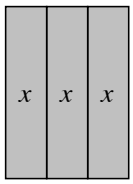
3-12. TOOTHPICKS AND ALGEBRA TILES

In Chapter 1, you played the game "Toothpicks and Tiles." However, this time, you will play it using algebra tiles!

Work with your team to find the "tiles" (the area) and "toothpicks" (the perimeter) for the following figures.

a. 

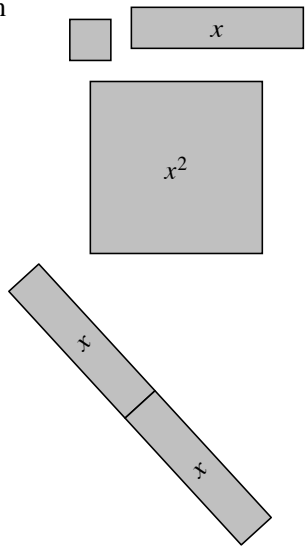
b. 

c. 

d. What is different about the shape in part (c)?

e. Is the perimeter of the shape in part (c) greater or less than the perimeter of the shape in part (a)? Explain your thinking.

3-13. The perimeter of each algebra tile can be written as an expression using variables and numbers.



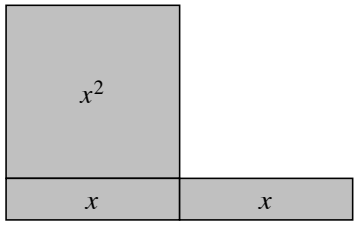
Write at least two different expressions for the perimeter of each tile shown at right.

a. Which way of writing the perimeter seems clearest to you? What information can you get from each expression?

b. Lisa wrote the perimeter of the collection of tiles at right as $2x+1+2x+1$ units, but her teammate Jody wrote it as $4x+2$. How are their expressions different?

c. Which expression represents the perimeter?

3-14. The expressions that you have written to represent area and perimeter are made up of **terms**. A **term** may be a single number, variable, or product of numbers and variables such as $3x$, x^2, 8, $-2xy$, or $6(x-7)$.



For the shape at right, one way to write the perimeter would be to include each side length in the sum:

$$P = x + x + x + 1 + x + x + 1 + x$$

a. How many x lengths are represented in this expression? How many unit lengths?

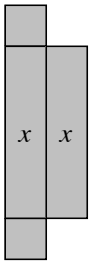
b. **Combining like terms**, that is, terms that contain the same variable, is a way of simplifying an expression. Rewriting the perimeter of the shape above as $P = 6x + 2$ **combines** the separate x-terms as $6x$ and combines the units in the term 2.

If you have not already done so, combine like terms for the perimeter of the different algebra tiles in problem 3-13.

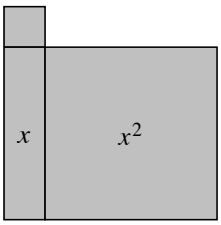
3-15. Using algebra tiles, on your desk, make the shapes shown below. Trace each shape and label the length of each side on your drawing. With your team, find and record the total perimeter and area for each shape. If possible, write the perimeter in more than one way.

a.

b.



c.



3-16. In problem 3-15, x is a variable that represents a number. The value of x determines the size of the perimeter and area of the shape.

Using the shapes from the previous problem, sketch and label each shape with the new lengths given below. Rewrite the expressions with numbers and simplify them to determine the perimeter and area of each shape.

a. $x = 6$ units for all three shapes

b. $x = 2$ units for all three shapes

c. Compare your method for finding perimeter and area with the method your teammates used. Is your method the same as your teammates? If so, is there a different way to find the perimeter and area. Explain the different methods.

3-17. LEARNING LOG

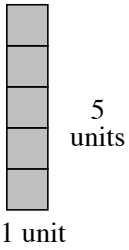
In your Learning Log, explain what a variable is in your own words. What does it mean for the length of an x-tile to be a variable? What is an expression? Use examples with drawings to illustrate your statements. Title this entry "Variables" and include today's date.

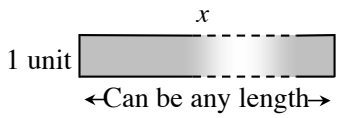
METHODS AND MEANINGS

MATH NOTES

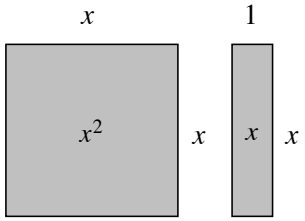
Naming Algebra Tiles

Algebra tiles help us represent unknown quantities in a concrete way. For example, in contrast to a 1×5 tile that has a length of 5 units, like the one shown at right, an x-tile has an unknown length. We can represent its length with a symbol or letter (like x) that represents a number, called a **variable**. Because its length is not thought to be fixed, the x-tile could be 6 units, or 5 units, or 0.37 units long.





Algebra tiles can be used to build **algebraic expressions**. An algebraic expression is similar to numerical expressions defined in Chapter 2, but its terms include variables. The three main algebra tiles are shown at right. The large square has a side of length x units. Its area is x^2 square units, so it is referred to as an x^2-tile.

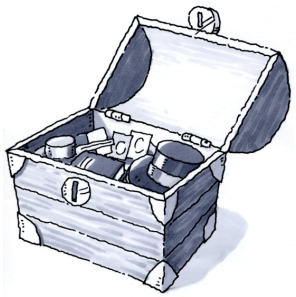


The rectangle has length of x units and width of 1 unit. Its area is x square units, so it is called an x-tile.

The small square has a side of length 1 unit. Its area is 1 square unit, so is called a one or unit tile. Note that the unit tile in this course will not be labeled with its area.

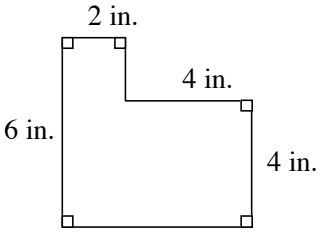
Review & Preview

3-18. Natalie and her little sister, Coco, found an old trunk in the attic. They decided to explore the contents of the trunk. It had 25 baseball cards, three hats, four pair of gloves, five books, two photo albums, one pair of boots and two hairbrushes.



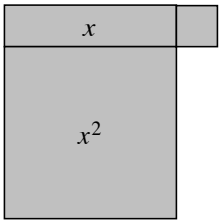
The girls want to organize the objects into two groups of things that are alike. Help them sort the objects and explain how you created the two groups.

3-19. Find the perimeter of the figure at right.

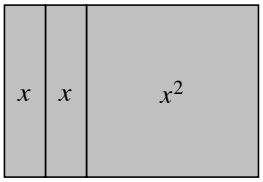


3-20. Copy the diagrams of algebra tiles below on your paper. Then find the perimeter of each shape.

a.



b.



3-21. Paige traveled to Australia and is making her favorite bread recipe. She usually bakes the bread in a 350ºF oven. She is surprised to learn that the oven temperatures in Australia are measured in degrees Celsius. Using the formula at right and the order of operations, help Paige determine how she should set the oven in degrees Celsius.

$$C = \frac{5(F-32)}{9}$$

3-22. Simplify the following expressions.

a. $\frac{2}{5} - \frac{1}{6}$ b. $\frac{3}{7} - \frac{7}{14}$ c. $\frac{5}{8} - \frac{2}{3}$

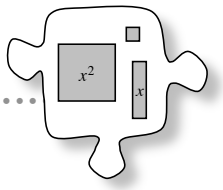
3-23. Mr. Hill has a deck of math flashcards that include addition, subtraction, and multiplication problems. Twenty-five cards show addition problems, 30 are subtraction problems, and 45 are multiplication problems.

a. What is the probability of drawing a card with an addition or subtraction problem on it?

b. If Mr. Hill adds 40 division flashcards to the deck, what will P(division) be?

c. In the new deck, which is greater: the probability of drawing an addition or subtraction flashcard, or the probability of drawing a multiplication or division flashcard? **Justify** your conclusion.

3.1.3 How can I rewrite it?



Combining Like Terms

In Lesson 3.1.2, you looked at different ways the perimeter of algebra tiles can be written, and created different expressions to describe the same perimeter. Expressions that represent the same perimeter in different ways are called **equivalent**. Today, you will extend your work with writing and rewriting perimeters to more complex shapes. You will rewrite expressions to determine whether two perimeters are equivalent or different. As you work today, keep these questions in mind:

Are there like terms I can combine?

How can I rearrange it?

How can I see (**visualize**) it?